DESIGN STANDARDS

ACCESSIBILITY

LAWS:

Communication

- Electronic and Information Technology Accessibility Standards (Section 508) (2000)
- Section 504 (Subpart E - Enforcement of Nondiscrimination on the Basis of Handicap in Programs or Activities Conducted by Dept of Interior) (PDF)
- Telecommunications Act Accessibility Guidelines (1998)

Architecture

- New Accessibility Standards Under the Barriers Act (ABAAS)
- ABAAS Guidelines (2004)
- Revised ADA-ABA Guidelines (2004)
- Public Rights of Way (upcoming)
- Outdoor Developed Areas (upcoming)

ADAAG supplements:

- State and Local Government Facilities (1998)
- Building Elements Designed for Children's Use (1998)
- Play Areas (2000)
- Recreation Facilities (2002)

Transportation

- ADA Accessibility Guidelines (ADAAG) for Transportation Vehicles (1991, amended 1998)
- Passenger Vessels (upcoming)

Code of Federal Regulations (CFR):

- 28 CFR Part 36 - Nondiscrimination On The Basis Of Disability By Public Accommodations And In Commercial Facilities

Federal Acquisition Regulations (FAR)

- Federal Acquisition Regulations

MANAGEMENT POLICIES

2006 Management Policies – The Guide to Managing the National Park System

- Chapter 1 –The Foundation
- Chapter 2 – Park System Planning
- Chapter 3 – Land Protection
- Chapter 4 – Natural Resource Management
- Chapter 5 – Cultural Resource Management
- Chapter 6 – Wilderness Preservation and Management
- Chapter 7 – Interpretation and Education

- Chapter 8 – Use of the Parks
- Chapter 9 – Park Facilities
- Chapter 10 – Commercial Visitor Services

DIRECTOR'S ORDERS (DOs)

- Director's Order 2, Park Planning, Chapter 2 of Management Policies, Park System Planning, and Planner's Source Book
- Director's Order 42, Accessibility for Park Visitors

BUILDING CODES

- International Building Code (IBC 2006)
- International Existing Building Code (IEBC 2006)

NPS MEMOS AND DIRECTIVES, STANDARDS, AND NPS GUIDELINES

NPS Memos

- ABAAS Adoption Memo (PDF)
- Disability Access in the NPS (PDF)
- NPS Audio-Visual Initiative (PDF)
- Service Animals (PDF)

Waivers and Modifications

Procedures for Submitting a Waiver or Modification Request

DSC Accessibility Requirements

- Accessible Route Design Standards
- Automatic Door Openers
- Campground and Picnic Area Accessibility - The Draft Final Accessibility Guidelines for Outdoor Developed Areas was released October 19, 2009 and is the best available guideline for campgrounds, picnic areas, trails and overlooks. These guidelines are required to be followed for all DSC projects.
- Detectable Warning Requirements
- Section 01430 - Contractor Quality Control Specification with Accessibility Inspection Report
- Sample Architectural Barriers Act Accessibility Standards (ABAAS) Compliance Plan (required for DD and CD deliverables) (PDF)

HFC Programmatic Accessibility Requirements

- Programmatic Accessibility Guidelines for National Park Service Interpretive Media
- Media Accessibility Information

CIVIL / ENVIRONMENTAL

LAWS:

(Note: All "Laws and Acts" listed below include the year in which the original law or act was signed into legislation. Incorporate any and all subsequent amendments, corrections, and additions when referencing the laws and acts listed below.)

- Asbestos Hazard Emergency Response Act (1986)
- Chemical Safety Information, Site Security, and Fuels Regulatory Relief Act (1999)
- Clean Air Act (1970)
- Coastal Zone Management Act (1972)
- Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund) (1980)
- Department of Transportation Act (1966)
- Emergency Planning and Community Right-To-Know Act (1986)
- Endangered Species Act (1973)
- Energy Policy Act (1992)
- Federal Insecticide, Fungicide and Rodenticide Act (1972)
- Federal Food, Drug, and Cosmetic Act (1938)
- Federal Water Pollution Control Act - Commonly known as the *Clean Water Act* (1977)
- Food Quality Protection Act (1996)
- Hazardous Materials Transportation Act (1998)
- Land and Water Conservation Fund Act (1965)
- National Environmental Policy Act (1969)
- National Park Service Organic Act (1916)
- National Trails System Act (1968)
- Occupational Safety and Health Act (1970)
- Oil Pollution Act (1990)
- Pollution Prevention Act (1990)
- Resource Conservation and Recovery Act - (Solid Waste Disposal Act) (1976)
- Safe Drinking Water Act (1974)
- Toxic Substances Control Act (1976)
- Wild and Scenic Rivers Act (1968)
- Wilderness Act (1964)

CODE OF FEDERAL REGULATIONS (CFR):

- 10 CFR Energy; Volumes 3 and 4, Chapters 2 and 3, Parts 200-999, Department of Energy
- 18 CFR Conservation of Power and Water Resources; Volume 1, Chapter 1, Parts 1-399, Federal Energy Regulatory Commission, Department of Energy
- 21 CFR Food and Drugs, Volumes 1-8, Chapter 1, Parts 1-1299, Food and Drug Administration, Department of Health and Human Services
- 23 CFR Highways; Volume 1, Chapters 1, 2, and 3, Parts 1-1399, National Highway Traffic Safety Administration and Federal Highway Administration, Department of Transportation
- 29 CFR Labor; Volumes 5-9, Chapter 17, Parts 1900-2006, Occupational Safety and Health, Department of Labor
- 36 CFR Parks, Forests, and Public Property; Volume 1, Chapter 1, Parts 1-199, National Park Service/Department of the Interior
- 40 CFR Protection of Environment; Volumes 1-30, Chapter 1, Parts 1-789, Environmental Protection Agency
- 42 CFR Public Health; Volume 1, Chapter 1, Parts 1-399 Public Health Service, Department of Health and Human Services
- 43 CFR Public Lands: Interior; Volume 1, Chapter 1, Office of the Secretary of the Interior
- 48 CFR Federal Acquisition Regulations System; Volume 5, Chapter 14, Parts 1400-1499, Department of the Interior

- 49 CFR Transportation

  49 CFR Volumes 2 and 3, Chapter1, Parts 100-199, Pipeline and Hazardous Materials Safety Administration, Department of Transportation

  49 CFR Volume 6, Chapter 5, Parts 500-599, National Highway Traffic Safety Administration, Department of Transportation

- 50 CFR Wildlife and Fisheries, Volumes 1-5, Chapter 1, Parts 17 – Endangered and Threatened Wildlife and Plants

EXECUTIVE ORDERS (EOS)

- Executive Order 11988 – Floodplain Management
- Executive Order 11990 – Protection of Wetlands
- Executive Order 13423 – Strengthening Federal Environmental, Energy, and Transportation Management

MANAGEMENT POLICIES

- 2006 Management Policies – The Guide to Managing the National Park System
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  - Chapter 10 – Commercial Visitor Services

DIRECTOR'S ORDERS (DOS)

- Director's Order 12 – Environmental Impact Analysis
- Director's Order 13A – Environmental Management Systems
- Director's Order 13B – Solid and Hazardous Waste Management (Being Developed)
- Director's Order 14 – Resource Damage Assessment and Restoration
- Director's Order 35A – Sale of Resources or Services to Support Activities Outside of Parks
- Director's Order 35B – Sale of NPS-Produced Utilities
- Director's Order 40 – Dams and Appurtenant Works
- Director's Order 41 – Wilderness Preservation and Management
- Director's Order 45 – National Trails System (Under Review)
- Director's Order 46A – Wild and Scenic Rivers within the National Park System
- Director's Order 47 – Sound Preservation and Noise Management
- Director's Order 50B – Occupational Safety and Health Program
- Director's Order 52C – Park Signs
- Director's Order 55 – Incident Management Program
- Director's Order 58 – Structural Fire Management
- Director's Order 65 – Explosives Use and Blasting Safety
- Director's Order 77-1 – Wetland Protection
- Director's Order 77-2 – Floodplain Management

- Director's Order 83 – Public Health
- Director's Order 87A – Park Roads and Parkways (Being Developed)
- Director's Order 87B – Alternative Transportation Systems (Being Developed)
- Director's Order 87D – Non-NPS Roads
- Director's Order 90 – Value Analysis

NPS GUIDELINES

Reference Manual 83(A1) – Drinking Water Guidelines: Detailed guidance on compliance with the mandates of the Safe Drinking Water Act (SDWA). In addition to the federal mandates under the SWDA, there may be other state and local regulations that may impact drinking water system operation and park liability that should be considered. The National Park Service is committed to being a "good neighbor" within the respective states and local communities, and compliance with any and all additional regulations is mandatory.

Reference Manual 83(A2) – Policy for the Control of Backflow and Cross-Connections

Reference Manual 83(B1) – Wastewater Systems. In addition to federal mandates for all wastewater systems, there may be other state and local regulations that may impact wastewater system operation and park liability that should be considered. The National Park Service is committed to being a "good neighbor" within the respective states and local communities, and compliance with any and all additional regulations is mandatory.

Reference Manual 83(B2) – In-Depth Design and Maintenance Manual for Vault Toilets

Reference Manual 83(B3) - Cleaning Recreation Sites

Reference Manual 83(B4) – Raw Sewage Spill Notification and Response Guidelines

Reference Manual 83(C1) – FDA Model Food Code

Reference Manual 83(C2) – Temporary Event Food Safety Guidelines

Reference Manual 83(D1) – Bathing Beaches

Reference Manual 83(E) – Illnesses and Diseases (Pending)

Reference Manual 83(F) – Backcountry Sanitation Guidelines

Reference Manual 83(G) – Vector Borne and Zoonotic Diseases

CODES AND STANDARDS

Site Design

American Association of State Highway and Transportation Officials (AASHTO) Standards
Asphalt Institute (AI) Standards
American Public Works Association (APWA) Standards
American Society of Civil Engineers (ASCE) Standards
American Society of Landscape Architects (ASLA) Standards
Army Corp of Engineers (ACOE) Standards
Chain Link Fence Manufacturers Institute (CLFMI) Standards
Irrigation Association (IA) Standards
National Asphalt Pavement Association (NAPA) Standards
Portland Cement Association (PCA) Standards

Water Systems / Wastewater Systems

American Concrete Institute (ACI) Standards
American Concrete Pipe Association (ACPA) Standards
American Petroleum Institute (API) Standards
American National Standards Institute (ANSI) Standards
American Society of Civil Engineers (ASCE) Standards
American Society of Mechanical Engineers (ASME) Standards
American Society of Plumbing Engineers (ASPE) Standards
American Society of Sanitary Engineering (ASSE) Standards
American Society for Testing and Materials (ASTM) Standards
American Water Works Association (AWWA) Standards
Environmental Protection Agency (EPA) Codes and Standards
International Code Council (ICC) Standards
International Plumbing Code (IPC)
Manufacturers Standardization Society of the Valve and Fittings Industry (MSSVFI) Standards
National Association of Corrosion Engineers (NACE) Standards
National Association of Pipe Coating Applicators (NAPCA) Standards
National Electrical Manufacturers Association (NEMA) Standards
National Fire Protection Association (NFPA) Codes and Standards
National Fluid Power Association (NFPA) Standards
National Institute of Standards and Technology (NIST) Standards
National Pollution Discharge Elimination System (NPDES) Standards
National Pipe Fabrication Institute (NPFI) Standards
NSF International (Formerly National Sanitation Foundation) Codes and Standards
Occupational Safety and Health Administration (OSHA) Standards
Precast/Prestressed Concrete Institute (PCI) Standards
Plumbing and Drainage Institute (PDI) Standards
Underwriters Laboratories (UL) Standards

Hazardous Materials

American National Standards Institute (ANSI) Standards
American Society of Civil Engineers (ASCE) Standards
American Society for Testing and Materials (ASTM) Standards
Chemical Safety Board (CSB) Standards
Code of Federal Regulations (40 CFR)
Department of Health and Human Services Standards
Department of Transportation (DOT) Standards
Environmental Protection Agency (EPA) Codes and Standards
General Services Administration (GSA) Standards
Hazardous Waste Operations and Emergency Response Standards
National Fire Protection Association (NFPA) Codes and Standards
National Institutes of Health Standards
Occupational Safety and Health Administration (OSHA) Standards
Pipeline and Hazardous Materials Safety Administration Standards

LANDSCAPE ARCHITECTURE

LAWS:

Code of Federal Regulations (CFR):

- 23 CFR Parts 1-999 - Federal Highway Administration, Department of Transportation
- 23 CFR Part 752 - Landscape and roadside development
- 28 CFR Part 36 Nondiscrimination On The Basis Of Disability By Public Accommodations And In Commercial Facilities
- 36 CFR Part 68 - The Secretary of the Interior's Standards for the Treatment of Historic Properties, 1995
- 40 CFR Parts 1500 - 1508: NEPA Regulations

Federal Acquisition Regulations (FAR)

- 25.2 Buy American Act—Construction Materials
- Part 36—Construction and Architect-Engineer Contracts
- Part 45—Government Property
- Part 46—Quality Assurance

Executive Orders (EOs)

- Transportation Equity Act for the 21st Century (TEA-21)

MANAGEMENT POLICIES

- 2006 Management Policies – The Guide to Managing the National Park System
    - Chapter 1 –The Foundation
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    - Chapter 3 – Land Protection
    - Chapter 4 – Natural Resource Management
    - Chapter 5 – Cultural Resource Management
    - Chapter 6 – Wilderness Preservation and Management
    - Chapter 7 – Interpretation and Education
    - Chapter 8 – Use of the Parks
    - Chapter 9 – Park Facilities
    - Chapter 10 – Commercial Visitor Services

DIRECTOR'S ORDERS (DOS)

- Director's Order 2, Park Planning, Chapter 2 of Management Policies, Park System Planning, and Planner's Source Book
- Director's Order 12, Environmental Impact Analysis
- Director's Order 17, Tourism
- Director's Order 28, Cultural Resource Management
- Director's Order 42, Accessibility for Park Visitors
- Director's Order 52C, Park Signs
- Director's Order 87A, Park Roads and Parkways (Being Developed)
- Director's Order 87B, Alternative Transportation Systems (Being Developed)
- Director's Order 87D, Non-NPS Roads Transportation

BUILDING CODES

- International Building Code (IBC-06)
- International Existing Building Code (IEBC 2006)

DIRECTIVES, STANDARDS, AND NPS GUIDELINES

- ABAAS Architectural Barriers Act Accessibility Standards
- NPS Architectural Drafting Requirements (Director's Order 10A)
- DSC Quality Assurance Guidelines Park General Management Plan, EIS, EA,.
- Special Regulations for Areas of the National Park System
- Guiding Principles of Sustainable Design
- Greening Federal Facilities, An Energy, Environmental, and Economic Resource Guide for Federal Facility Managers and Designers
- Park Road Standards (1984) (PDF format, 1.7MB)
- Alternative Transportation Systems Guidebook
- Manual on Uniform Traffic Control Devices (MUTCD), 2003 Edition U.S. Department of Transportation - Federal Highway Administration
- Federal Lands Highway, Project Development and Design Manual, U.S. Department of Transportation - Federal Highway Administration
- Federal Lands Highway Construction Manual, U.S. Department of Transportation - Federal Highway Administration
- Flexibility in Highway Design, U.S. Department of Transportation Officials - Federal Highway Administration
- Standard Specifications for Construction of Roads and Bridges on Federal Highway Projects, U.S. Department Of Transportation - Federal Highway Administration
- Part 2, Designing Sidewalks and Trails for Access, U.S. Department of Transportation - Federal Highway Administration
- Guide for the Development of Bicycle Facilities, American Association of State Highway and Transportation Officials
- Transportation Planning Guidebook, U.S. Department of Interior - National Park Service
- National Scenic Byways Guide, May 2002

ARCHITECTURE

LAWS:

Public Laws

- ABAAS Guidelines (2004)
- National Historic Preservation Act of 1966 (Section 106)

Code of Federal Regulations (CFR):

- 41 CFR 101-17 Assignment and Utilization of Space

Federal Acquisition Regulations (FAR)

Executive Orders (EOs)

- Executive Order 13164 Requiring Federal Agencies To Establish Procedures To Facilitate the Provision of Reasonable Accommodation
- Executive Order 13423 Strengthening Federal Environmental, Energy, and Transportation Management

MANAGEMENT POLICIES

- 2006 Management Policies – The Guide to Managing the National Park System
- The Secretary of the Interior's Standards for the Treatment of Historic Properties, 1995
- Guiding Principals of Sustainable Design

DIRECTOR'S ORDERS (DOS)

- DSC CAD Standards Guide
- Director's Order (Do) 10a, Reference Manual 10a, Guideline For Preparation of Design and Construction Drawings
- Director's Order (DO) 28, Cultural Resource Management
- Director's Order (DO) 58, Structural Fire Management
- Director's Order (DO) 89, Acquisition and Management of Leased Space
- Director's Order 90, Value Analysis

BUILDING CODES

- **2006 International Building Code** IBC-06 (for all projects in which Predesign begins after October 1, 2009)
- **2006 International Existing Building Code** IEBC-06 (for all projects in which Predesign begins after October 1, 2009)

DIRECTIVES, STANDARDS, AND NPS GUIDELINES

- Accessibility Standards Under the Barriers Act (ABAAS)
- ASHRAE 90.1, 2007
- DSC Quality Assurance Guidelines

PROFESSIONAL GUIDANCE

AIA (American Institute of Architects) Handbook of Professional Practice

SUSTAINABILITY:

- See Sustainability Standards

BUILDING ENVELOPE MOISTURE CONTROL

For general guidance refer to ASHRAE Fundamentals, 2005 and/or Moisture Control Handbook (Lstiburek and Carmody, 1991)

Typical Concrete Slab Assembly Detail

A. Concrete Slab-on-Grade Floor

Typical Wall Assembly Details

B. Ventilated Crawl Space
C. Unventilated Crawl Space
D. Basement Wall
E. Masonry Wall
F. Wood Stud Wall
G. Steel Stud Wall
H. Dropped Ceiling with Plenum

Typical Roof Assembly Details

I. Ventilated Attic
J. Unventilated Attic
K. Unventilated-No Attic
L. Ventilated-No Attic

Typical Wall Ventilation and Drainage

- Provide Air Space Behind Exterior Siding. A ventilated wall cavity behind exterior siding or brick veneer will reduce inward driven moisture and increase drying to the exterior.
  - Be aware that most exterior cladding materials (wood, stone, brick, stucco) retain moisture. When solar radiation strikes a wall, vapor is driven into and out of the wall. The cladding's primary function is to act as an ultraviolet screen.
- Provide Unfaced Impermeable Rigid Insulation over a drainage membrane (consisting of membrane, trowel-on or spray-applied drainage plane, air barrier and vapor retarder)

Typical Vapor Barriers

- Vapor Barrier Placement. The roof or wall assembly should always:
  - Interior--Dry inwards from the control layers
  - Exterior--Dry outwards from the control layers

- Definition per ASHRAE:
    - Vapor Barrier*

        Vapor Impermeable – 0.1 perms or less
        Vapor Semi-impermeable – 1.0 perms or less and greater than 0.1 perms

    - Vapor Retarder

        Vapor Semi impermeable – 10 perms or less and greater than 1.0 perms
        Vapor Permeable – Greater than 10 perms

The term* **"vapor barrier"*, which is commonly used, is somewhat misleading since it does not completely bar the transmission of water vapor. A vapor barrier is actually a vapor-resistant membrane, and is more properly called a* **"vapor retarder."**

- Roofs
    - Ventilated Attic

        Vapor Retarder on conditioned side of insulation or Vapor Barrier on conditioned side of insulation in very cold climates

    - Ventilated No-Attic

        Vapor Retarder on conditioned side of insulation or Vapor Barrier on conditioned side of insulation in very cold climates

    - Unventilated No-Attic Ceiling

        Exterior Rigid Insulation or impermeable cavity insulation with Vapor Retarder under finish sheathing

- Above Grade Walls
    - Typically, it is not good to install a vapor barrier (polyethylene) on the inside of an air-conditioned wall assembly. Beware of inadvertently creating a vapor barrier finish in a location or plane where one does not belong (vinyl wall coverings and foil-backed batt cavity insulation should be avoided).
    - Beware of trapping moisture between drainage plane and vapor barrier that can ultimately lead to mold and rot.
    - Beware that in any typical wall, vapor is driven both outward and inward (from the membrane drainage plane air barrier and vapor retarder) by a high differential between the exterior brick / stone / stucco / siding
    - Do not use oil base paint on a conditioned wall surface as it acts as an impermeable vapor barrier in the wrong location. Always use latex acrylic paint or vapor semi-permeable textured wall finish.
    - Consider using spray foam insulation in awkward or hard-to-reach locations (insure foam is protected by fire-resistant material such as gyp board).

- Below Grade Concrete Walls
    - Avoid use of plastic covered blanket insulation attached to the inside of a below-grade concrete wall (the diaper).
    - Attach semi-permeable continuous rigid insulation to the outside or inside of the concrete below-grade wall.
    - Install wood frame cavity wall over rigid insulation and fill with unfaced fiberglass or damp spray cellulose.
    - Do not install vapor barrier so wall is allowed to dry out.

- Concrete Slabs

    - Typically, Concrete slabs should not be placed on a sand layer installed over a polyethylene vapor barrier.

        Always place concrete in direct contact with plastic vapor barriers.
        Use a low water-to-cement ratio concrete, max. .45, and top cure the slab with damp burlap.

SPECIFIC PRODUCTS AND MATERIALS

Division 3 – Concrete

- Consider sustainable practices such as using flyash in concrete mixture where appropriate to reduce cement content

Division 4 – Masonry

- Consider "life-cycle assessment" when selecting masonry products

Division 5 – Metals

- Avoid using "COR-TEN Steel" products on buildings. Runoff from this product stains surfaces when coming in contact and adds pollutants to soils and ground water.

Division 6 – Wood and Plastics

- For sustainability, consider using "Certified Forest Products" as designated by the Forest Stewardship Council, if appropriate for project and cost effective.
- If appropriate for project and cost effective, consider using agro board / bio products for interior fiberboard/plywood products applications (particleboard made from renewable products such as wheat, straw, sunflower hulls, etc.)
- If appropriate for project and cost effective, consider recycled plastic products for interior applications such as countertops.

Division 7 - Thermal and Moisture Protection

- See Roofing/Waterproofing Standards as part of this document

Division 8 - Doors and Windows

- Door and window selection should be based on improved thermal performance.
- Verify with park when selecting architectural hardware. As a standard in most NPS parks, all keyed locks in a project should be keyed to the "Best" lock system.
- Glazing for each building elevations should be selected based on building orientation and improved thermal performance

Division 9 – Finishes

- Select products that require low maintenance and are durable.
- If appropriate and cost effective, consider using "Green" products when selecting products.

Division 10 – Specialties

- Select products that require low maintenance and are durable (ie. toilet partitions)

- Toilet accessories to match existing manufacture used in park
- Signage system shall comply with NPS and individual park sign standards and by appropriate for the park setting. See NPS sign directive and standards. (create link)
- All communication (telephone, radio, alarms) systems must be coordinated with the park staff

Division 11 – Equipment

- Verify with park the need for any specialized equipment

Division 12 – Furnishings

- If appropriate, consider using “Green” products when selecting furnishings.
- Consider using door mats at all main or key entrances for improved indoor air quality

Division 13 – Special Construction

- If appropriate and cost effective, consider Solar/ Wind Turbine Systems for power generation.
- If appropriate and cost effective, consider Building Automation System (Energy Management System) for efficient energy monitoring.

Division 14 – Conveying Systems

- All Federal facilities must comply with ABAAS. The use of elevators or wheelchair/stair lifts may be required for some facilities.
- If appropriate and cost effective, consider using vegetable-based hydraulic fluid elevator system
- Hoist or cranes may be required for some maintenance facilities. Avoid designing open work pits in maintenance facilities due to safety hazard.

ROOFING / WATERPROOFING

BUILDING CODES

- IBC (International Building Code) 2006
- IPC (International Plumbing Code) 2006
- ASCE 7 (American Society of Civil Engineers) Minimum Design Loads for Buildings and Other Structures

DIRECTIVES, STANDARDS, AND NPS GUIDELINES

- National Roofing Contractors Association – Roofing and Waterproofing Manual
- Factory Mutual Global
- Underwriters Laboratories
- Architectural Sheet Metal Manual, 2003 by Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA)
- Design Handbook (Section 4 – Architectural Detail) and (Section 5 - Architectural Specifications), by Copper Development Association
- Copper in Architecture – Handbook (publication 4050) by Copper Development Association
- Wind load as calculated using ASCE 7
- Determination of fire rated roof Classification
- Roof drainage as calculated using IPC or other established sources
- Determine dew point location in roof assembly and vapor barrier needs

PROFESSIONAL GUIDANCE

Asphalt Shingles Roofs

- Specify a 2-ply laminated shingle, conforming to ASTM D3462, with a minimum 50-year material warranty and a minimum 15-year non-prorated labor and material watertightness warranty (i.e. Certainteed-Sure Start Plus 5 Star, GAF-Golden Pledge, Malarkey-steep slope system, etc.)
- In humid and wet climates, specify algae resistant shingles
- In hailstorm areas, specify impact resistance shingles passing an UL 2218 test for Class 3 or 4.
- In high wind areas, (greater than 90 mph) specify wind resistant shingles rating to wind speed determined by ASCE 7, and require a 10-year wind warranty
- In snow/ice climates, specify fully adhered moisture protection underlayment extending from the eave to 3 feet from the inside face of the exterior wall, at valleys, ridges and along dormer or other walls. Use cold roof design technology if possible.
- Fasten shingles with minimum12 gauge corrosion resistant nails only. Minimum nail head diameter shall be 3/8". Shank shall penetrate minimum of 3/4" in wood decking or completely through plywood decking.
- Asphalt-saturated felt underlayment shall meet ASTM D 226 and/or D 4869. Use double layers on roof slopes less than 4:12.
- Specify roof perimeter edge metal and step flashing at walls and chimneys.
- Minimum slope 3:12.
- Specify open, closed, or woven valleys

Clay and Concrete Tile Roofs

- Specify clay tile manufacturers who offer a 20-year labor and material warranty, for the installed cost of roof, to replace defective tiles resulting from defects in materials or workmanship
- Clay Tile shall meet or exceed ASTM C1167 Grade 1 requirements for durability and ASTM C1167 Type I, for appearance
- Concrete tile shall meet or exceed ASTM C1492 requirements.

- In freeze/thaw climates specify clay tile manufacturers who have tiles with a moisture absorption rate of less than 1% per ASTM C67. Concrete tile shall have a minimum compressive strength of 7500 psi, shall not have more than 1% loss in dry weight per ASTM C67 and not absorb more than 8% of the dry weight in ASTM C140 immersion test.
- Specify 2 layers of 30# asphalt-saturated felt underlayment meeting ASTM D 226 and/or D 4869.
- In snow/ice climates or as required for warranty, specify fully adhered moisture protection underlayment extending from the eave to 3 feet from the inside face of the exterior wall, at valleys, ridges and along dormer or other walls. Use cold roof design technology if possible.
- In hailstorm areas, specify manufacturers who provide a minimum 10-year hail warranty covering material replacement of damaged tiles

Green Roof Systems

- Reference Green Roof Systems Manual (2007 Edition) by National Roofing Contractors Association (NRCA)
- Reference LEED Certification (DSC Design Standards – Sustainability)
- Green Roof System Components
  - Fully adhered waterproofing membrane, protection course
  - Root barrier
  - Drainage layer
  - Moisture-resistant insulation
  - Aeration layer
  - Moisture-retention layer
  - Reservoir layer
  - Filter fabric layer
  - Engineered soil-based growth medium with plantings
    - Permanent installations (annual maintenance required)
    - Tray systems (flexibility, seasonal use, enhanced drainage)
- Green Roof Assemblies
  - Structural deck
  - Waterproofing membrane
  - Associated green roof components
  - Engineered overburden (soil based growth medium and plantings)
- Design Considerations
  - Internally drained roof surfaces preferred
  - Choose shallow, moderate depth or deep roof system based on initial cost, structural considerations, roof pitch, maintenance requirements, sustainability (LEED) objectives and aesthetic goals.
  - XPS rigid insulation (minimum compressive strength of 40 psi) (R-value of 5.0 per inch thickness)
  - EPS rigid insulation (minimum 2-pound density) to be used as filler material to reduce weight and attain slope contour
  - Install moisture-resistant insulation above the membrane to protect the membrane against thermal gradients and contact wear/damage
  - Restrict moderate and deep roof systems to roofs with 2:12 pitch or less. Use extensive shallow roof systems where roof pitch is greater than 2:12.
  - Employ edge retainers and erosion-control devices to grid landscape layout and stabilize overburden on steeper roof slopes. Controlling soil slippage and retention/distribution of water important to landscape health.

Metal Roofs

- Specify metal roof manufacturers who offer Full System Manufacturer's Roofing Warranty for 20-year labor and material warranty, for the installed cost of roof, to repair leaks in the roof panels, flashing and trim resulting from defects in materials or workmanship. Roof manufacturers shall be required to inspect the work during construction (i.e. AEPS span-weather tightness, Berridge-Total Single Source, MBCJ-single source III, etc.).
- Verify with manufacturer their underlayment requirement for the 20-year warranty
- Steep roof (hydrokinetic) roofs shall pass air and water infiltration tests per ASTM E1646 and E1680. Low slope (hydrostatic) roofs shall pass water infiltration tests per ASTM E2140. Submit test report.

- Specify Kynar 500 or Hylar 5000 paint finish on metal panels which require paint.
- Specify 22 gage galvalume/zincalume and/or galvanized metal roofs. For structures located in coast regions use 0.040" aluminum or 20 oz copper. For high profile structures, use any of the above 3 materials.
- For architectural panel roofs, specify snap type standing or batten seam with continuous length panels. Panel should be kept off substrate by manufacturer's clips. Double lock standing seams should only be used in high snow areas where snow will accumulate on the roof over the winter
- For structural or structural/architectural panel roofs, specify concealed fasteners and clips for panel attachment. No fasteners shall be located in the pan of the panel except at the ridge.
- Panels and trim shall be rolled formed at the manufacturer's prime manufacturing plant
- Specify manufactured prepared shop drawing on a minimum 24" by 36" sheet.
- Metal shingles and shingle panels to be used on steep slope (3:12 or greater). Investigate the bottom, top and side of each shingle to determine the interlocking mechanism and watertightness of the lap, joint and seam. Examine ridge, valley, hip and perimeter flashings profiles for watertightness. These products maybe problematic on roofs that retain snow for long periods of time.
- Specify rosin paper slip sheet under all architectural metal roofs
- In snow/ice climates or as required for warranty, specify fully adhered moisture protection underlayment extending from the eave to 3 feet from the inside face of the exterior wall, at valleys, ridges and along dormer or other walls. Use cold roof design technology when possible.
- Specify self-adhered high temperature underlayment.

SBS Modified Bitumen Roofs

- Specify 2-ply system where roofing products, including each type of sheet, are all manufactured in the United States, supplied by a single manufacturer which has been successfully producing the specified types of primary products with the same materials without making adjustments, modifications or alterations to the chemical or physical composition of the products for not less than the specified warranty period.
- Specify a 20 year system and require a 15-year System Roofing Manufacturer's Warranty for labor and material, without monetary limitation, to correct defects in materials or workmanship. Warranty shall contain no exclusions for random occurrences of ponding water.
- APA systems are not permitted
- Specify SBS roof systems where high puncture resistance, exposure to abuse or frequent access is needed on the roof to maintain mechanical equipment.
- Specify torch down and adhesive systems, avoid hot mop asphalt.
- Specify a dense, fire and water resistance cover board made from gypsum or other man made materials to be placed over the deck or insulation board. Use adhesive to attach cover board to insulation.
- Specify cant strips and curbs to be pressure treated wood unless metal curbs are used. Fiber products are not permitted.
- Specify a pre-manufactured 2-piece counterflashing; coping system; roof edge/fascia system; and mechanical equipment curbs.
- Minimum roof pitch of 1/4"/ft and 1/8"/ft along valleys
- Install stepping stone pavers with shims on low slope roof surfaces along a path from the roof hatch to mechanical equipment requiring cyclic maintenance, installed with a sufficient area to limit damage to finished roof system from foot traffic and service tools/equipment .

Single–Ply Membrane Roofs

- Specify roofing products, all manufactured in the United States, supplied by a single manufacturer which has been successfully producing the specified types of primary products with the same materials without making adjustments, modifications or alterations to the chemical or physical composition of the products for not less than the warranty period.
- Specify a 20 year system and require a 15-year System Roofing Manufacturer's Warranty for labor and material, without monetary limitation, to correct defects in materials or workmanship. Warranty shall contain no exclusions for random occurrences of ponding water.

- Specify PVC (60 mil minimum thickness) and EIP (45 mil minimum thickness) systems to be mechanically attached. Roof membrane is visible from ground shall be fully adhered.
- EPDM systems shall be fully adhered 60 mil thickness, using 7" wide tape seams, and be warranted for 20 years.
- TPO membranes shall not be specified.
- Specify single-ply roof system when foot traffic is minimal, roof shape is complex or when numerous roof penetrations are present.
- Specify a dense, fire and water resistance cover board made from gypsum or other man made materials to be placed over the deck or insulation board. Use adhesive to attach cover board to insulation.
- Specify a pre-manufactured 2-piece counterflashing; coping system; roof edge/fascia system; and mechanical equipment curbs.
- Minimum roof pitch of 1/4"/ft and 1/8"/ft along valleys
- Install stepping stone pavers with shims on low slope roof surfaces along a path from the roof hatch to mechanical equipment requiring cyclic maintenance, installed with a sufficient area to limit damage to finished roof system from foot traffic and service tools/equipment .

Slate Roofs

- Specify slate tile manufacturers who provide a 75-year material warranty. The installer shall provide a 5-year leak proof warranty for the installed cost of the roof, to replace defective flashings and tiles resulting from defects in materials or workmanship.
- Specify slate manufacturers whose products meet ASTM C406 and can certify their slate to a Grade S1 classification by providing test results which are not more than 3 years old.
- Specify 3/8" minimum thick slate in freeze/thaw, high wind or heavy hail areas, 1/4" minimum thick slate in other areas. Avoid slate from Pennsylvania.
- Specify two layers of 30# asphalt-saturated felt underlayment meeting ASTM D 226 and/or D 4869 or one layer of fully adhered moisture protection 40 mil minimum butyl-adhesive based underlayment. Use a 3" minimum headlap for roof slopes between 4:12 to 8:12.
- In snow/ice climates, specify fully adhered moisture protection 40 mil minimum butyl-adhesive based underlayment extending from the eave to 3 feet from the inside face of the exterior wall, at valleys, ridges and along dormer or other walls. Use cold roof design technology if possible.
- Specify 10 gage copper slating nails, stainless steel, bronze or cut-brace roof nails and fasten with 2 nails per slate. In high wind areas or when 3/4" or thicker slate is used, fasten with 4 nails per slate.
- Provide eave cant for starter course.
- Flashings shall be fabricated from 20 oz copper or 24 gage stainless steel. Open valley pan shall be formed with a “W” or “V” shaped splash diverter.

Specialty Roofs

- Evaluated on a case-by-case basis

Wood Shakes and Shingle Roofs

- National Parks are slowly transitioning away from wood products as a result of increased fire danger throughout the west, the limited availability of domestic supplied material, and the reduce life expectancy of the product in many parts of the country. However, in some cases historic preservation standards may dictate the use of these products.
- Specify No. 1 premium official blue label western red cedar shingle; premium grade western red cedar shake; or pressure treated No. 1 vertical grain, all clear yellow pine shingle.
- Specify one layer (for shingles) or two layers (for shakes) of 15# asphalt-saturated felt underlayment meeting ASTM D 226 and/or D 4869 or one layer of fully adhered ice and water protection 40 mil minimum butyl-adhesive based underlayment. The second layer of felt is interlaced between courses when installing shakes.

- In snow/ice climates, specify fully adhered moisture protection 40 mil minimum butyl-adhesive based underlayment extending from the eave to 3 feet from the inside face of the exterior wall, at valleys, ridges and along dormers or other walls. Use cold roof design technology if possible.
- Use a 3 layer starter course for roofs with each course hanging over the lower one by 1/4".
- Specify a minimum 4:12 pitch roof, prefer a 5:12 minimum pitch and shingle widths between 3 and 9 inches.
- Specify copper or zinc sheets at ridge in humid climates to reduce moss growth
- Hand nail shakes and shingles. Nail guns and staples are not allowed

Waterproofing Systems

- Specify waterproofing products, all manufactured in the United States, supplied by a single manufacturer which has been successfully producing the specified types of primary products with the same materials without making
  adjustments, modifications or alterations to the chemical or physical composition of the products for not less than the warranty period.
- Specify a minimum 10-year Manufacturer's Warranty for labor and material, without monetary limitation, to correct defects in materials or workmanship. Warranty shall contain no exclusions for random occurrences of ponding water.
- Specify the use of certified contractors to apply the waterproofing system and that the work be inspected by the manufacturer at a minimum of once a week during installation
- Waterproofing below the water table may limit the selection of the waterproofing membrane.
- Select waterproofing systems that are typically used on substrates as stated in the manufacturer's literature.

STRUCTURAL

LAWS:

United States Code (USC):

- Compliance with Nationally Recognized Codes USC Title 40, Chapter 12, Section 619

Executive Orders (EOs)

- Executive Order 12699 Seismic Safety of Federal and Federally Assisted or Regulated New Building Construction (PDF)
- Executive Order 12941 Seismic Safety of Existing Federally Owned or Leased Buildings (PDF)

BUILDING CODES AND STANDARDS

- IBC-06
- IEBC-06
- ASCE 7-05
- ACI 318-05
- ACI 301-05
- ACI 530-05
- AISC ASD 9th edition, LRFD 3rd edition, or AISC 13th edition
- NDS-2005
- AITC Timber Construction Manual, 5th edition

DIRECTIVES, STANDARDS, AND NPS GUIDELINES

Load Requirements

- Floor live Load: IBC 2006
- Roof Live Load: IBC 2006
- Snow Load: IBC 2006 as required for building location, with consideration of:
    - Unbalanced snow load
    - Snow drifting at lower roofs and projections
    - Roof valley snow drifting
    - Sliding snow
- Wind Load: IBC 2006 as required for building location
- Seismic: IBC 2006 as required for building location
- Vehicle Bridges: HS20
- Pedestrian Bridges and Boardwalks: 85 psf

Foundations

- Frost Depth: As required for building location

Concrete

- Minimum slab-on-grade thickness 4" at thinnest point

- Minimum compressive strength at 28 days: as required by design, but not less than 3000psi
- Minimum 15% flyash content
- Reinforcing steel: ASTM A615 Grade 60

Masonry

- Concrete masonry minimum f'm: 1500 psi
- Reinforcing Steel: ASTM A615 Grade 60
- Below grade walls and retaining walls grouted solid

Steel

- W Shapes: ASTM A992, 50 ksi
- S, M, HP and Channels: ASTM A36 or A572 Grade 50
- Angles and Plates: ASTM A36
- TS or HSS: ASTM A500, Grade B, 46 ksi
- Minimum Fillet Weld Size: 3/16"

Wood

- Minimum roof sheathing thickness, 5/8"
- Minimum wall sheathing thickness 1/2"
- Framing Lumber (depending on location and availability)
    - Southern Pine No. 2 or better
    - Hem Fir No.2 or better
    - Douglas Fir Larch No.2 or better
- Provide blocking between roof framing members at bearing locations
- Provide plywood or OSB sheathing over heavy timber decking to create a diaphragm
- Whenever possible, engineered lumber (Glulams, LVL's) shall be substituted for solid sawn members larger than 8x8.
- Use of pentachlorophenol pressure treatment for glulams is not acceptable.

PROFESSIONAL GUIDANCE

Coastal/Marine Construction

- Coastal Construction Manual
- Coastal Engineering Manual EM 1110-2-1100

Tornado Shelters

- FEMA 361

MECHANICAL

BUILDING CODES AND STANDARDS

HVAC

- ASHRAE Guideline 0-2005, “The Commissioning Process”
- ASHRAE Guideline 1.1-2007, “HVAC&R Technical Requirements for The Commissioning Process”
- ANSI/ASHRAE 15-2007, “Safety Standard for Refrigeration Systems”
- ASHRAE 52.2-2007, “Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size”
- ASHRAE 55-2004, “Thermal Environmental Conditions for Human Occupancy”
- ASHRAE 62.1-2007, “Ventilation for Acceptable Indoor Air Quality”
- ASHRAE 62.2-2007, “Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings”
- ANSI/ASHRAE/IESNA 90.1-2007, “Energy Standard for Buildings Except Low-Rise Residential Buildings”
- ANSI/ASHRAE 90.2-2007, “Energy-Efficient Design of Low-Rise Residential Buildings”
- IECC 2006 “International Energy Conservation Code”
- IMC 2006 “International Mechanical Code”
- ANSI/SMACNA 006-2006, “HVAC Duct Construction Standards – Metal and Flexible”
- NFPA Codes and Standards (See Safety/Fire Protection Standards)

Plumbing

- IPC 2006 “International Plumbing Code”
- ABAAS “Architectural Barriers Act Accessibility Standard” (Barrier-Free Plumbing Fixtures)

Fuel Systems

- 2006 IFGC “International Fuel Gas Code”
- NFPA Codes and Standards (See Safety/Fire Protection Standards)
- API RP 1604-1996, “Closure of Underground Petroleum Storage Tanks”
- API RP 1615-1996, “Installation of Underground Petroleum Storage Systems”
- PEI RP 100-2005, “Recommended Practices for Installation of Underground Liquid Storage Systems”
- PEI RP 200-2003, “Recommended Practices for Installation of Aboveground Storage Systems for Motor Vehicle Fueling”
- UL-58-1996, “Standard for Steel Underground Tanks for Flammable and Combustible Liquids”
- UL 142-2006, “Standard for Steel Aboveground Tanks for Flammable and Combustible Liquids”
- UL 1316-1994, “Glass-Fiber-Reinforced Plastic Underground Storage Tanks for Petroleum Products, Alcohols, and Alcohol-Gasoline Mixtures”
- UL 2085-1997, “Standard for Protected Aboveground Tanks for Flammable and Combustible Liquids”

Stationary Engines and Cogeneration

- NFPA Codes and Standards (See Safety/Fire Protection Standards)

Conveying Systems

- ANSI/ASME A17.1-2007, “Safety Code for Elevators and Escalators”
- ANSI MH 30.1-2007, “Specification for Dock Leveling Devices”
- ASME B30.11-2004, “Monorails and Underhung Cranes”

- ASME B30.16-2007, “Overhead Hoists (Underhung)”
- ICC/ANSI A117.1-2003, “Accessible and Usable Buildings and Facilities”
- ANSI/ALI ALCTV-1998, “Safety Requirements for Automotive Lifts - Construction, Testing, and Validation”

DIRECTIVES, STANDARDS, AND NPS GUIDELINES

Mechanical Drawing Preparation Standards

- See Drafting Standards

PROFESSIONAL GUIDANCE

- HVAC
  - Outdoor Design Conditions: 2005 ASHRAE “Fundamentals Handbook”, Chapter 28 (Climatic Design Information)
  - Hot and Humid Climates: ASHRAE “Guide for Buildings in Hot and Humid Climates”
  - Energy Conservation:
    - ASHRAE “Advanced Energy Design Guide for Small Office Buildings”
    - ASHRAE “Advanced Energy Design Guide for Small Retail Buildings”
    - ASHRAE “Advanced Energy Design Guide for Small Warehouses and Self Storage Buildings”
  - Building Material Thermal Properties: 2005 ASHRAE "Handbook of Fundamentals", Chapter 25 (Thermal and Water Vapor Transmission Data)
  - Indoor Design Conditions for Public, Office, and Living Spaces:
    - Winter: 72 degrees F
    - Summer: 75 degrees F
    - Maximum Relative Humidity: 60%
  - Indoor Design Conditions for Shop and Storage Spaces:
    - Winter: 65 degrees F
    - Summer: 80 degrees F
  - General Ventilation: In accordance with ASHRAE 62.
  - Restroom Ventilation: Minimum 2 CFM per square foot of floor area.
  - Acoustical Criteria (maximum values):
    - Auditoriums and Exhibit Spaces: NC25
    - Office Spaces: NC35
    - Shop Spaces: NC45
  - Refrigerant Bearing Equipment: All refrigerant bearing equipment shall be CFC-free.

- Plumbing
  - Domestic Water Heating: 2007 ASHRAE “HVAC Applications Handbook”, Chapter 49 (Service Water Heating)
  - Compressed Air Systems: 1988 CAGI “Compressed Air and Gas Handbook”
  - Plumbing Fixtures: All plumbing fixtures and fittings shall be low-flow water conserving types, conforming to 1992 Energy Policy Act (EPAct) requirements.
  - Backflow Prevention: Comply with each park's backflow prevention regulations. As minimums, provide double check valve assemblies on all fire services or other water service connections that may produce objectionable backflow and reduced pressure zone backflow assemblies on all makeup water connections to HVAC equipment or other water service connections that may produce hazardous backflow.
  - Metering: All domestic water, reclaimed water, and fuel gas services to each building shall be metered in accordance with NPS Staff Directive 78-10.
  - Water Pressure: Pressure reducing valves shall be provided as necessary to limit water pressure in buildings to 80 psig maximum. Booster pumps shall be provided as necessary to maintain a minimum of 25 psig at the furthest plumbing fixture at design flowrate conditions.

SAFETY / FIRE PROTECTION

LAWS:

- 5 U.S.C. §7902 (Safety Program)
- 15 U.S.C. §2225 (Fire Prevention and Control)
- 29 U.S.C. §668 (Occupational Safety and Health)
- 40 U.S.C. §619; (Construction, Alteration, and Acquisition of Public Buildings)

Code of Federal Regulations (CFR):

- 29 CFR Part 1910 (Occupational Safety and Health Standards)
- 29 CFR Part 1926 (Safety and Health Regulations for Construction)

MANAGEMENT POLICIES

- 5.3.1. Protection and Preservation of Cultural Resources
- 5.3.1.2 Fire Detection, Suppression, and Post-fire Rehabilitation and Protection
- 9.1.8. Structural Fire Protection and Suppression
- 9.4.2. Museum Collections Management Facilities

DIRECTOR'S ORDERS (DOS)

- Director's Order (DO) 50B, Risk Management and Reference Manual 50B, "Risk Management"
- Director's Order (DO) 58, Structural Fire Management and Reference Manual (RM) 58, "Structural Fire Management" (PDF)

CODES AND STANDARDS

- ANSI/ASSE Z117.1, Safety Requirements for Confined Spaces
- International Building Code
- International Fire Code
- International Existing Building Code
- NFPA 1, Uniform Fire Code
- NFPA 10, Portable Fire Extinguishers
- NFPA 11, Low-, Medium-, and High Expansion Foam
- NFPA 12, Carbon Dioxide Extinguishing Systems
- NFPA 13, Installation of Sprinkler Systems
- NFPA 13D, Sprinkler Systems in One- and Two- Family Dwellings and Manufactured Homes
- NFPA 13R, Sprinkler Systems in Residential Occupancies up to and including 4 stories in Height
- NFPA 14, Standpipe and Hose Systems
- NFPA 15, Water Spray Fixed Systems
- NFPA 16, Foam-Water Sprinkler and Foam-Water Spray Systems
- NFPA 17, Dry Chemical Extinguishing Systems
- NFPA 17A, Wet Chemical Extinguishing Systems
- NFPA 20, Installation of Stationary Pumps
- NFPA 22, Water Tanks for Private Fire Suppression
- NFPA 24, Private Fire Service Mains
- NFPA 25, Water-Based Fire Protection Systems
- NFPA 30, Flammable and Combustible Liquids Code
- NFPA 30A, Motor Fuel Dispensing Facilities

- NFPA 31, Installation of Oil-Burning Equipment
- NFPA 33, Spray Application Using Flammable or Combustible Materials
- NFPA 34, Dipping or Coating Processes using Flammable or Combustible Liquids
- NFPA 37, Stationary Combustion Engines and Gas Turbines
- NFPA 40, Storage and Handling of Cellulose Nitrate Film
- NFPA 45, Fire Protection for Laboratories Using Chemicals
- NFPA 51B, Welding, Cutting, Other Hot Work
- NFPA 52, Vehicular Fuel Systems
- NFPA 54, National Fuel Gas Code
- NFPA 55, Compressed Gases and Cryogenic Fluids
- NFPA 58, Liquefied Petroleum Code
- NFPA 59A, Liquefied Natural Gas
- NFPA 61, Fire and Dust Explosions in Agricultural and Food Processing Facilities
- NFPA 68, Venting of Deflagrations
- NFPA 69, Explosion Prevention Systems
- NFPA 70, National Electrical Code
- NFPA 70E, Electrical Safety in the Workplace
- NFPA 72, National Fire Alarm Code
- NFPA 75, Information Technology Equipment
- NFPA 76, Telecommunications Facilities
- NFPA 77, Static Electricity
- NFPA 79, Electrical Standard for Industrial Machinery
- NFPA 80, Fire Doors and Windows
- NFPA 80A, Exterior Fire Exposures
- NFPA 82, Incinerators, Waste and Linen Handling Systems and Equipment
- NFPA 85, Boiler and Combustion Systems Hazards
- NFPA 86, Ovens and Furnaces
- NFPA 88A, Parking Structures
- NFPA 90A, Air-Conditioning and Ventilation Systems
- NFPA 90B, Warm Air Heating and Air-Conditioning Systems
- NFPA 91, Exhaust Systems for Air Conveying of Gases
- NFPA 92A, Smoke Control Systems
- NFPA 92B, Smoke Management Systems in Malls, Atria, and Large Spaces
- NFPA 96, Ventilation Control and Fire Protection of Commercial Cooking Operations
- NFPA 101, Life Safety Code
- NFPA 101A, Alternative Approaches to Life Safety
- NFPA 102, Grandstands, Folding and Telescopic Seating, Tents, and Membrane Structures
- NFPA 105, Smoke Door Assemblies and Other Opening Protectives
- NFPA 110, Emergency and Standby Power Systems
- NFPA 111, Stored Electrical Energy Emergency and Standby Power Systems
- NFPA 130, Fixed Guideway Transit and Passenger Rail Systems
- NFPA 150, Fire and Life Safety in Animal Housing
- NFPA 160, Use of Flame Effects Before an Audience
- NFPA 170, Fire Safety and Emergency Symbols
- NFPA 204, Smoke and Heat Venting
- NFPA 211, Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances
- NFPA 214, Water-Cooling Towers
- NFPA 220, Types of Building Construction
- NFPA 225, Model Manufactured Home Installation
- NFPA 232, Protection of Records
- NFPA 241, Safeguarding Construction, Alteration, and Demolition Operations
- NFPA 251, Fire Resistance of Building Construction and Materials
- NFPA 252, Fire Tests of Door Assemblies
- NFPA 253, Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source

- NFPA 255, Surface Burning Characteristics of Building Materials
- NFPA 257, Window and Glass Block Assemblies
- NFPA 259, Potential Heat of Building Materials
- NFPA 262, Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces
- NFPA 265, Room Fire Growth Contribution of Textile Coverings on Full Height Panels and Walls
- NFPA 274, Fire Performance Characteristics of Pipe Insulation
- NFPA 275, Thermal Barriers Used Over Foam Plastic Insulation
- NFPA 285, Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components
- NFPA 286, Contribution of Wall and Ceiling Interior Finish to Room Fire Growth,
- NFPA 288, Floor Fire Door Assemblies Installed Horizontally in Fire Resistance–Rated Floor Systems
- NFPA 289, Individual Fuel Packages
- NFPA 290, Passive Protection Materials for Use on LP-Gas Containers
- NFPA 291, Fire Flow Testing and Marking of Hydrants
- NFPA 301, Safety to Life from Fire on Merchant Vessels
- NFPA 302, Pleasure and Commercial Motor Craft
- NFPA 303, Marinas and Boatyards
- NFPA 306, Control of Gas Hazards on Vessels
- NFPA 307, Marine Terminals, Piers, and Wharves
- NFPA 312, Fire Protection of Vessels During Construction, Conversion, Repair
- NFPA 403, Aircraft Rescue and Fire-Fighting Services at Airports
- NFPA 407, Aircraft Fuel Servicing
- NFPA 409, Aircraft Hangars
- NFPA 415, Airport Terminal Buildings, Fueling Ramp Drainage, and Loading Walkways
- NFPA 418, Heliports
- NFPA 430, Storage of Liquid and Solid Oxidizers
- NFPA 434, Storage of Pesticides
- NFPA 484, Combustible Metals,
- NFPA 490, Storage of Ammonium Nitrate
- NFPA 495, Explosive Materials Code
- NFPA 496, Purged and Pressurized Enclosures for Electrical Equipment
- NFPA 497, Classification of Flammable Liquids, Gases or Vapors for Electrical Installations in Chemical Process Areas
- NFPA 499, Classification of Combustible Dusts and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas
- NFPA 501, Manufactured Housing
- NFPA 501A, Fire Safety Criteria for Manufactured Home Installations, Sites, and Communities
- NFPA 502, Road Tunnels, Bridges, and Other Limited Access Highways
- NFPA 520, Subterranean Spaces
- NFPA 555, Evaluating Potential for Room Flashover
- NFPA 560, Storage, Handling, and Use of Ethylene Oxide for Sterilization and Fumigation
- NFPA 654, Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids
- NFPA 664, Fires and Explosions in Wood Processing and Woodworking Facilities
- NFPA 701, Fire Tests for Flame Propagation of Textiles and Films
- NFPA 703, Fire Retardant–Treated Wood and Fire-Retardant Coatings for Building Materials
- NFPA 704, Identification of the Hazards of Materials for Emergency Response
- NFPA 705, Field Flame Test for Textiles and Films
- NFPA 720, Carbon Monoxide Detection and Warning Equipment
- NFPA 730, Premises Security
- NFPA 731, Electronic Premises Security Systems
- NFPA 750, Water Mist Fire Protection Systems
- NFPA 780, Lightning Protection Systems
- NFPA 820, Fire Protection in Wastewater Treatment and Collection Facilities
- NFPA 853, Stationary Fuel Cell Power Systems

- NFPA 909, Protection of Cultural Resource Properties
- NFPA 914, Fire Protection of Historic Structures
- NFPA 1141, Fire Protection Infrastructure for Land Development in Suburban and Rural Areas
- NFPA 1142, Water Supplies for Suburban and Rural Fire Fighting
- NFPA 1194, Recreational Vehicle Parks and Campgrounds
- NFPA 1221, Emergency Services Communications Systems
- NFPA 1402, Fire Service Training Centers
- NFPA 2001, Clean Agent Fire-Extinguishing Systems
- NFPA 2010, Fixed Aerosol Fire-Extinguishing Systems

DIRECTIVES, STANDARDS, AND NPS GUIDELINES

- 411 DM (Museum Property Handbook, Volume 1, Preservation and Protection of Museum Property)
- National Historic Preservation Act, Section 106, and 36 CFR 800
- 485 DM 19 (Fire Safety)

PROFESSIONAL GUIDANCE

General Safety

- The design shall meet or exceed applicable safety, health, environmental and related trade codes and standards. It should be remembered that these codes and standards represent the minimum acceptable level of safety. Nothing precludes the design, construction or operation at a higher level of safety than that provided for in these codes and standards.
- The facility shall be compliant with OSHA requirements and hazards should be mitigated using engineered solutions.
- The design team should include a Certified Safety Professional.

Confined Spaces

- Confined Spaces should be minimized.
- Backflow Preventers and electrical switchgear should be located above grade, or inside of a building, rather than in a pit.

General Fire Protection

- A Code Analysis and/or Fire Safety Plan is required. (RM 58, page 27 (PDF))
- The design team should include a licensed Fire Protection Engineer.
- Code Equivalencies and Variances are encouraged and shall be developed by a Fire Protection Engineer for approval by the DSC Building Official and/or Regional Fire AHJ.
- Fire modeling is encouraged to minimize fire and life safety systems impact, especially in historical structures.

Fire Protection Systems

- Although there are some exceptions, new buildings, buildings undergoing renovation, or buildings with a change in occupancy, shall have automatic sprinkler system protection. Unless there is an IBC requirement, the following do not require automatic sprinkler protection:
  - Business, Storage and Industrial occupancies less than 5000 sq ft
  - Comfort Stations
  - Pump Houses/Sewage Lift Station
  - Condemned/Abandoned Property

  (NPS Reference Manual 58 Structural Fire, Page 6)

- Performance based designs are encouraged.
- Compact or mobile storage is Extra Hazard Group 1 with one hour fire separation.
- Sprinkler control valves shall be electrically supervised.
- Piping: Copper, Schedule 40 steel, or plastic.
- Dry Pipe and PreAction Systems: Hot-dip galvanized Schedule 40 pipe/fittings (threaded or cut groove only) or Copper; all pendent heads shall be dry pendents; all piping shall be sloped to drain preferably to the main riser; low point drains shall be drum drips and shall be minimized.
- Double check backflow prevention required.
- Gravity water supplies are preferred. The next preference is combined fire and domestic systems using commercial pumps. Fire pumps or pressure tanks may be used. The preferred water supply will minimize the required Inspection, Testing, and Maintenance.
- High Pressure Water Mist or Special Extinguishing Systems (e.g. FM-200) shall be approved by the Regional AHJ early in the design process.

Fire Alarm Systems

- Although there are some exceptions, new buildings, buildings undergoing renovation, or buildings with a change in occupancy, shall be provided with an automatic fire alarm system. Unless there is an IBC requirement, the following do not require an automatic fire alarm system:
  - Business, Storage and Industrial occupancies less than 5000 sq ft
  - Comfort Stations
  - Pump Houses/Sewage Lift Station
  - Condemned/Abandoned Property

  (NPS Reference Manual 58 Structural Fire, Page 6)

- The system shall be based on NFPA 72 as Total (Complete) Coverage using smoke detectors in all spaces. In unheated areas, heat detectors may be more appropriate.
- Visual appliances shall be installed in accordance with NFPA 72 and ABAAS. Strobe candela ratings need to be shown. (US Access Board, Technical Bulletin : Visual Alarms)

ELECTRICAL

DIRECTOR'S ORDERS (DOS)

- Director's Order 15, NPS Wireless Spectrum Management
- Director's Order 58, Structural Fire Management

BUILDING CODES

- NFPA Codes and Standards, but not NFPA 5000
- NESC National Electrical Safety Code
- NEC 2008

DIRECTIVES, STANDARDS, AND NPS GUIDELINES

- IEEE - Standards
- EIA/TIA Standards 568 & 569
- IESNA Illuminating Engineers Society of North America

PROFESSIONAL GUIDANCE

Load Requirements:

- NEC 2008
- Nameplate/Manufacturers Data
- 25% minimum spare capacity typical for future expansion

Utilities:

- Coordinate with utility companies as early as possible
- Underground distribution as much as possible
- NPS prefers not to own & operate utilities
- TVSS Protection on all Service Entrances

Telecommunication:

- EIA/TIA Standards, see above
- Cat 6 Cabling - (2) per 3/4" conduit; (1) Data, (1) Voice per each voice / data outlet (typical)
- Telephone Service Entrance (Demarcation Point) - Meet Local Phone Company Requirements

Conduit:

- Site specific, in general Schedule 40 PVC for underground
- Minimum branch circuit conduit size = 3/4"
- Provide conduit for all wiring (minimum size 3/4")
- See table below

Power Wiring:

- THWN / THHN

- Underground - THWN / XHHW
- No MC or AC type cabling in walls in new construction
- No surface mounted MC or AC type cabling where rigid raceway can be used
- Copper conductors
- Copper Buswork

Overcurrent Protection:

- Fully rated - Series rated is not desired
- Breakers preferred for reset capability (sizes 15 amperes or greater)
- Fuse selection shall comply with NEC requirements and equipment manufacturers recommendations

Equipment and Materials:

- Listed and labeled as defined in NEC Article 100 for application
- Conduit - see table below for environment and use

ENVIRONMENT	RACEWAY	BOXES, ENCLOSURES, CABINETS
Dry locations, concealed	RMC, IMC, EMT, RNC, ENT[1], FMC, LFMC, LFNC, WW	SM, FS/FD, NM, NEMA 1
Exposed, subject to damage	RMC, IMC	SM, FS/FD, NM, NEMA 1
Exposed, not subject to damage	RMC, IMC, EMT, RNC, ENT[2], FMC, LFMC, LFNC	SM, FS/FD, NM, NEMA 1
Wet locations, subject to damage	RMC[3], IMC[3], EMT[3], WW[7]	FS/FD, NEMA 4, 4X
Wet locations, not subject to damage	RMC[3], IMC[3], EMT[3], RNC, ENT[2], LFMC, LFNC, WW[7]	FS/FD, NM, NEMA 4, 4X
Outdoor locations, exposed to rain, sleet, wind-blown dust, and external icing	RMC[3], IMC[3], EMT[3], LFNC, WW[7]	FS/FD, NEMA 3, 3R, 3S
Submerged	RMC[3], IMC[3], RNC	NEMA 6, 6P
Embedded in concrete	RMC, IMC, EMT[4], RNC, ENT[4]	FS/FD
Under concrete slab	RMC, IMC, EMT[4]	
Underground, direct burial	RMC[3], IMC[3], EMT[3], RNC, ENT, LFNC	
Embedded burial	RMC, IMC, EMT[4], RNC, ENT[4], LFNC	
Industrial location, general	RMC, IMC, EMT, RNC, FMC, LFMC, WW	FS/FD, SM, NEMA 12, 12K
Subject to corrosion	RMC[3], IMC[3], EMT[3], RNC, LFMC	NEMA 4X, 11
Subject to oil, vapors	RMC, IMC, LFMC	FS/FD, NEMA 13
Hazardous Class I, Division 1[8]	RMC, IMC, FMC[8]	NEMA 7, 8
Hazardous Class I, Division 2[8]	RMC, IMC, LFMC, FMC, WW[5]	FS/FD, NEMA 1, 7, 8, 12
Hazardous Class II, Division 1[8]	RMC, IMC, LFMC, WW[5]	NEMA 9
Hazardous Class II, Division 2[8]	RMC, IMC, LFMC, WW[5]	FS/FD, NEMA 1, 9, 12
Hazardous Class III[8]	RMC, IMC, LFMC, WW[5]	FS/FD, NEMA 12

TABLE LEGEND	TABLE NOTES
RMC - Rigid metal conduit IMC - Intermediate metal conduit EMT - Electrical metallic tubing FMC - Flexible metal conduit LFMC - Liquidtight flexible metal conduit RNC - Rigid nonmetallic conduit ENT - Electrical nonmetallic tubing LFNC - Liquidtight flexible metal conduit WW - Wireway SM - Sheet metal box FS/FD- Cast metal box NM - Nonmetallic NEMA - Re: NEMA 250 type classification	1 — Finishes must provide barrier with 15-minute rating. 2 — Building not more than 3 stories above grade. 3 — Corrosion protection required. 4 — With fittings for purpose. 5 — Enclosed and gasketed. 6 — Dusttight wireway only. 7 — Raintight wireway only. 8 — Suitable for hazardous location.

LIGHTING

MANAGEMENT POLICIES

- 2006 Management Policies – The Guide to Managing the National Park System
    - 4.10 Lightscape Management

BUILDING CODES AND STANDARDS

- NFPA Codes and Standards
- NESC National Electrical Safety Code
- IEEE- Standards
- IESNA 9th Edition – Illuminating Engineers Society of North America
- UL – Underwriter's Laboratory (Product Safety)
- ASRAE / IESNA 90.1 / 2007 (Energy Efficiency)

DIRECTIVES, STANDARDS, AND NPS GUIDELINES

- Advanced Lighting Guidelines, Report Number DOE/EE-0008, NTIS Order Number DE94005264, U.S. Dept. of Energy, Washington, DC, 1993.
- International Dark-Sky Association Guidelines

PROFESSIONAL GUIDANCE

General:

- Illumination levels per IESNA recommendations (normal and NFPA / IBC Standards (egress)
- Lighting systems should be designed to provide visual comfort at low energy cost.

Connected Lighting Loads:

- 0.7 to 1.4 W/ s.f. depending on the space function –commercial facilities at the lower end and retail at the higher end.
- **Exhibit Areas**: the maximum lighting power density should be 0.7 (where life cycle cost effective) watt per square foot. An increase of 0.7 watt per foot is allowed for "highlighting art or exhibits", bringing the maximum allowable lighting power density for the exhibit space to 1.4 watts per square foot.
- Reduce connected lighting loads with carefully planned task and ambient lighting. (Ambient lighting should be utilized as a strategic method for meeting code restrictions on energy use in all types of facilities). The most energy efficient lighting installations are based on a balance of three lighting layers- ambient, task and accent lighting. The expected goal is energy-effective lighting design.

Fixtures and Components:

- Listed as defined in NEC Article 100 for application
- Complement architectural style proposed and integrate with structure
- Utilize fixtures (luminaires) that efficiently deliver light and are well suited to the expected tasks.
- Use high-efficiency electronic ballasts in all new fixtures.
- Incorporate appropriate lighting controls. A well-designed lighting control system has the potential to reduce lighting energy use by 30-50%.

Lamps:

- Low wattage with relatively high output lamps
- Minimize the use of incandescent lighting
- Color rendering of fluorescent lighting is very important. CRI levels above 80 are recommended.
- Comply with NEMA and UL

Value:

1. Lighting as a medium to an end – to visual comfort, user pleasure and satisfaction, and productivity over the long term.
2. Lighting design as a process. Specifically, it should be viewed as the process of integrating light into the fabric of architecture (both the architectural concept and the physical structure).

EXTERIOR LIGHTING:

1. Uplighting landscape and exterior architectural features is not acceptable. Dark night skies are a vital park resource and it is very important to protect the dark night skies and reduce light pollution. Light pollution is often caused by excessive or misdirected outdoor lighting.
2. Use lighting only when necessary (addressing safety and security issues). Timers, photocells and motion detectors are an effective way of maximizing light during the hours that is needed most. Direct light only where it is needed and avoid over lighting.
3. The use of white light sources increase nighttime visibility, renders landscaping more natural, and maximizes peripheral vision. Consider using Metal Halide vs. High-Pressure Sodium.
4. Specify full-cutoff luminaires to direct nearly all their light downward, thus reducing light pollution.
5. Integrate security lighting with the architecture (soffits, overhangs).

DAYLIGHTING DESIGN

1. A baseline profile will help establish the potential opportunities for daylighting. Achieving good daylighting is often more of an art than a technical, engineered solution. The eye's perception of light is a key part of visibility. The quality of daylight and the human need for connection to daylight cannot be emphasized enough.
2. Integrate daylighting design with electric lighting, HVAC, and architectural systems. Incorporate automated daylight dimming where there is a significant amount of natural light but where turning electric lights off altogether would be inappropriate.

SUSTAINABILITY

LAWS:

(1) Relevant Statutes
(2) Executive Orders
(3) Regulations

Public Laws

The full text of these regulations, orders and laws can be found at
http://www.usa.gov/Topics/Reference_Shelf/Laws.shtml

PL 111-8
Omnibus Appropriations Act, 2009 (section 748) – This appropriations act incorporates Executive Order 13423 into law.

PL 110-140
Energy Independence and Security Act of 2007 – Among other things this legislation:

- Lengthens study period for life cycle cost analyses from 25 years to 40 years
- Requires projects to dramatically reduce their use of fossil fuel derived energy
- Requires projects to derive at least 30% of their energy for water heating from solar (where LCC effective)
- projects with a footprint exceeding 5,000 square feet must use site planning, design, construction, and maintenance strategies to control storm water runoff.

Summary of Energy Independence and Security Act of 2007

PL 109-058
Energy Policy Act of 2005 – Among other things this legislation requires:

- Reduced building energy consumption by at least 30% (20% for renovation) compared with ASHRAE 90.1/IECC (where LCC effective)
- Reduced water usage
- Specification of premium efficiency motors
- Procurement of both on-grid and off-grid renewable energy generation systems (solar hot water, solar electric, solar outdoor lighting, small wind turbines, fuel cells, etc) where such systems are life-cycle cost-effective
- Specification of recovered minerals in cement and concrete as recommended by EPA guidance in their “Comprehensive Procurement Guidelines”
- Provides a mechanism whereby design firms may obtain an income tax credit up to $1.80 per square foot of designed building, when design can be shown to meet specific energy targets.
- Requires the use of Energy Star or FEMP designated products – for products covered by either of these programs.

PL 102-486
Energy Policy Act of 1992

Code of Federal Regulations (CFR):

7CFR PART 2902
Guidelines for Designating Biobased Products for Federal Procurement

10CFR430
Energy Conservation Program for Consumer Products: Energy Conservation Standards for Residential Furnaces and Boilers; Final Rule

10CFR433
Energy Efficiency Standards for the Design and Construction of New Federal Commercial and Multi-Family High-Rise Residential Buildings (Final Rule goes into effect Jan 22, 2008)

10CFR434
Energy Code for New Federal Commercial and Multi-Family High Rise Residential Buildings (Final Rule goes into effect Jan 22, 2008)

10CFR435
Energy Efficiency Standards for New Federal Low-Rise Residential Buildings (Final Rule goes into effect Jan 22, 2008)

10CFR436
Federal Energy Management and Planning Programs – Requires federal agencies to specify Energy Star qualified or FEMP designated products (in product categories covered by these two programs) unless an exception is granted, in writing, by the head of the agency.

Federal Register Vol. 71, No.160 8/18/2006

Standards for Premium Energy Efficiency Electric Motors for Federal Acquisition

Federal Acquisition Regulations (FAR)

FAR Parts 11, 23 and 52.2 – The Federal Acquisition Regulations was amended in 2000 to address environmental considerations in contracting and procurement procedures. These parts outline acquisition planning, energy and water efficiency, renewable energy, use of recovered materials, hazardous materials, and waste reduction.

Executive Orders (EOs)

The full text of these regulations, orders and laws can be found at
http://www.archives.gov/federal-register/executive-orders/disposition.html

Executive Order 13221
Energy Efficient Standby Power Devices

- Signed: July 31, 2001
- Federal Register page and date: 66 FR 40571, August 2, 2001

Executive Order 13423
Strengthening Federal Environmental, Energy, and Transportation Management

- Signed: January 24, 2007
- Federal Register page and date: 72 FR 3919, January 26, 2007 (Incorporated into Public Law 111-8)
- Amends: EO 13327, February 4, 2004
- Revokes:
  EO 13101, September 14, 1998
  EO 13123, June 3, 1999
  EO 13134, August 12, 1999
  EO 13148, April 21, 2000
  EO 13149, April 21, 2000

Executive Order 13514
Federal Leadership in Environmental, Energy, and Economic Performance

- Requires compliance with the Guiding Principles for new construction and major renovation.
- Defines agency goals for greenhouse gas reductions.
- Requires water conservation for potable as well as non-potable water.
- Describes site planning goals.
- Discusses historic buildings.

MANAGEMENT POLICIES

- Renewable Energy Development by the Department of the Interior – This order establishes the development of renewable energy as a priority for the DOI, establishes a departmental task force and clarifies DOI roles and responsibilities to accomplish the goal.

- 2006 Management Policies – The Guide to Managing the National Park System

  - 1.9.5.2 Facilities
  - 4.9 Soundscape Management – Preserve, to the greatest extent possible, the natural soundscapes of the parks.
  - 4.10 Lightscape management (natural ambient)— the effective use of good design to appropriately light areas and minimize or eliminate light clutter, the spill over of light into areas where light is not wanted, and light pollution, all of which wastes energy and impacts park visitors, neighbors and resources.
  - 9.1.1.6 Sustainable Energy Design – "..All projects that include visitor centers or major visitor services facilities must incorporate LEED (Leadership in Energy and Environmental Design) standards to achieve a silver rating."
  - 9.1.4.2 Acquisition of Environmentally Preferable and Energy-Efficient Products
  - 9.1.7 Energy Management
    - Alternative energy 9.1.5; 9.2; 9.4.5
    - Charges to concessionaires 10.2.6.4
    - Conservation 9.1.1; 9.1.3.1; 9.1.7; 9.2
    - Efficiency 9.1.4.1; 9.1.4.2; 9.1.7; 9.3.2.1; 9.3.2.3
    - Performance 9.1.1
    - Sustainable design 9.1.7
    - Use of environmentally friendly and energy efficient products 9.1.4.2
  - 10.2.2 Commercial Visitor Services Planning
    - Adopts appropriate energy and water conservation, source reduction, and environmental purchasing standards and goals

- Director's Order 13A – Environmental Management Systems

  - This DO articulates the principles and policies for developing and implementing a Servicewide EMS approach that guides environmental decision-making and actions at all levels. Its purpose is to help ensure compliance with regulatory requirements and a commitment to pollution prevention, waste reduction, sustainable planning, environmentally preferable purchasing, and the incorporation of environmental best management practices.

BUILDING CODES

- International Building Code 2006
- International Existing Building Code 2006
- ASHRAE 0, 52.2, 55, 62.1, 90.1

FEDERAL DIRECTIVES, STANDARDS, AND NPS GUIDELINES

- Guiding Principles of Sustainable Design
- Comprehensive Procurement Guideline for Products Containing Recovered Materials (CPG)
- Federal Leadership in High Performance and Sustainable Buildings Memorandum of Understanding (NEW!!! Updated (12/08) Guiding Principles. Update includes GP's for existing buildings.)
- Instructions for Implementing Executive Order 13423
- Metering of Water and Energy use – New Construction
- Water Efficiency Improvement Goal for Federal Agencies

PROGRAMS

- NPS Climate Friendly Parks
- NPS Climate Leadership In Parks (CLIP) Tool
- Best Management Practice (BMP)
- Federal Energy Management Program (FEMP)

    - Energy Star® and Other Energy-Efficient Products: The National Park Service promotes the purchase of Energy Star® products and/or products that are in the upper 25 percent of energy efficiency as designated by the Federal Energy Management Program (FEMP).

SUSTAINABILITY RATING SYSTEMS

- Leadership in Energy and Environmental Design (LEED) – A third-party certification program and the nationally accepted benchmark of the design, construction and operation of high performance green buildings. LEED provides building owners and operators with the tools they need to have an immediate and measurable impact on their buildings' performance.
- Green Globes – The genesis of this system was the Building Research Establishment's Environmental Assessment Method (BREEAM). In 1996, the Canadian Standards Association (CSA) published BREEAM Canada for Existing Buildings. In 2000, the system became an online assessment and rating tool under the name Green Globes for Existing Buildings.
- Sustainability Tracking, Assessment, and Rating System – STARS is a voluntary, self-reporting framework for gauging relative progress toward sustainability for colleges and universities

RESOURCES

General Design Guidance

- ASHRAE GreenGuide: The Design, Construction, and Operation of Sustainable Buildings, 2nd ed. – Provides guidance to designers of HVAC&R systems in how to participate effectively on design teams charged with producing green buildings.
- Building Life Cycle Cost (BLCC) Program – A National Institute of Standards and Technology (NIST) developed and Department of Energy (DOE) endorsed life cycle cost computer program, with annually updated discount rates for use on federal projects.
- **Commissioning**
    - The Building Commissioning Guide – GSA guide for "Total Building Commissioning".
    - California Commissioning Guide: New Buildings – Guide by the State of California explaining building commissioning.
    - Commissioning Sample Documents and Templates – From California Commissioning Collaborative
- **Energy**
    - Advanced Energy Design Guide for Small Office Buildings – A design guide for achieving 30% energy savings over ASHRAE 90.1-1999. Provides regionally specific recommendations for the thermal performance of building envelope elements, HVAC system efficiency recommendations, etc.

        - Building America - DOE program to find energy-efficient solutions for new and existing housing that can be implemented on a production basis.
        - Meeting the 2030 Challenge Through Building Codes – Interim code equivalents to achieve a 50% reduction in fossil fuel derived energy for buildings (55% reduction is required by 2007 Energy Independence & Security Act, starting in 2010).
        - DOE High Performance Buildings Database – Includes information from buildings around the world, ranging from homes and commercial interiors to large buildings and even whole campuses and neighborhoods. These may be certified green projects, or simply projects that have one or more notable environmental features. The information has been reviewed for consistency and presentation, but in most cases, the details have not been independently verified.
        - Energy Plus – Free building energy modeling software from Department of Energy.
        - EQuest – Free "sophisticated, yet easy-to-use building energy analysis tool" from Department of Energy
- Handbook for Planning and Conducting Charrettes for High-Performance Projects – A handbook, published by the National Renewable Energy Laboratory, that furnishes guidance for planning and conducting "high-performance building" charrettes.
- Integrated Design Process (IDP) – A set of resources for solar and low energy building designs including guidelines and case studies.
- Greening Federal Facilities – A DOE document with recommendations for incorporating sustainability.
- Federal Center Green Building Program – The Green Building Program Area includes guidance, programs, processes, regulations, case studies, tools, and resources for learning about and optimizing green building decisions throughout the facility delivery process.
- Labs21 – Information for improving the energy performance of laboratories.
- Office of the Federal Environmental Executive – Promotes sustainable environmental stewardship throughout the federal government.
- The Federal Network for Sustainability – Examples, tools and resource links.
- U.S. Environmental Protection Agency – EPA's main green building website.
- U.S. General Services Administration Sustainable Design Program
- U.S. Green Building Council – Non-profit organization dedicated to sustainable building design and construction. Developers of the LEED building rating system.
- Water efficiency: Federal Requirements (DOE) – Review of federal requirements and references to best management practices (BMPs).
- Whole Building Design Guide – The Gateway to Up-To-Date Information on Integrated Whole Building Design Techniques and Technologies

Product Guidance

General

- U.S. Department of Energy (DOE) Energy Efficiency and Renewable Energy (EERE) Home Page – US Department of Energy web site for information on energy efficiency and renewable energy technologies.
- Energy Star – US EPA Energy Star programs and products help save the environment and save consumers money by using less energy through advanced design or construction.

Recycled or Biopreferred Products

- EPA's Comprehensive Procurement Guidelines (CPG)
- USDA BioPreferred Program – Includes information on submitting products for designation, instructions on meeting requirements to purchase biobased materials, and many other useful topics.
    - BioPreferred Biobased Products Catalog – The content of this catalog is limited to products which have been designated for preferred procurement status.
- Forest Certification Resource Center – Global Resource for learning about forest certification.
- Forest Stewardship Council
    - Smart Guide to Green Building Wood Sources
    - Smart Guide to Sustainable Furniture and FSC-Certified Products

- Smart Guide to Paper and Print Sources
- Designing and Building with FSC

Water Use (Indoor)

- EPA WaterSense – Certification system for indoor and outdoor water efficient products: toilets, bathroom sinks, and showerheads.

Water Use (Outdoor)

- EPA WaterSense – Certification system for indoor and outdoor water efficient products: installers, irrigation control technologies

Architectural

- Energy Star Reflective Roofing
- Energy Star Windows

Mechanical

- Energy Star – US EPA Energy Star listed heating and cooling equipment: oil furnaces, gas furnaces, boilers, air conditioners and heat pumps, and light commercial heat pumps and air conditioners
- DOE on Energy Efficient Heating and Cooling Systems
- DOE on Water Heating Systems
- GAMA Water Heater, Furnace, and Boiler Efficiency Data
- Ground Source Heat Pump design and installation information

Electrical

- EPA Energy Star Lighting – Energy efficient lighting product recommendations
- DOE on Lighting
- Illuminating Engineering Society of North America (IESNA) – Lighting books, Lighting Guide, Lighting design, Illumination